Topic 7:

Matrices

Why Are We Studying Matrices?

Matrices have plenty of uses in Computer Science. E.g.:

- Representation . . .
  - . . . of the graph data structure (see CSc 345)
  - . . . of functions and relations (see Topics 8 and 9)
- Affine transformations in Computer Graphics

Matrix Fundamentals (1 / 3)

Definition: Matrix

Notation:

Matrix Fundamentals (2 / 3)

Definition: Square Matrices

Definition: Matrix Equality

Matrix Fundamentals (3 / 3)

Definition: Transposition

Definition: Matrix Symmetry

Example(s):

Matrix Operations (1 / 5)

1. Matrix Addition

Definition: Matrix Addition (a.k.a. Matrix Sum)

Example(s):

Matrix Operations (2 / 5)

2. Scalar Multiplication

Definition: Scalar

Definition: Scalar Multiplication

. . . . . .

Example(s):

Matrix Operations (3 / 5)

3. Matrix Multiplication

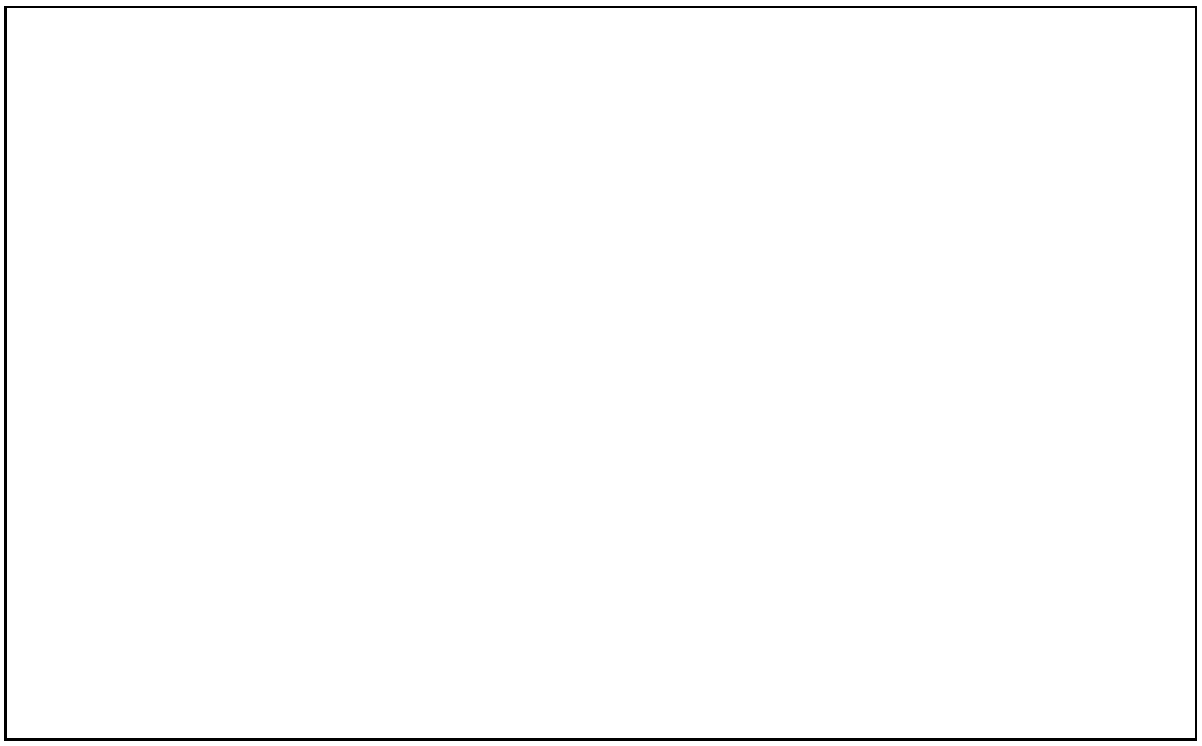
Definition: Matrix Multiplication (a.k.a. Matrix Product)

. . . . . .

. . . . . .

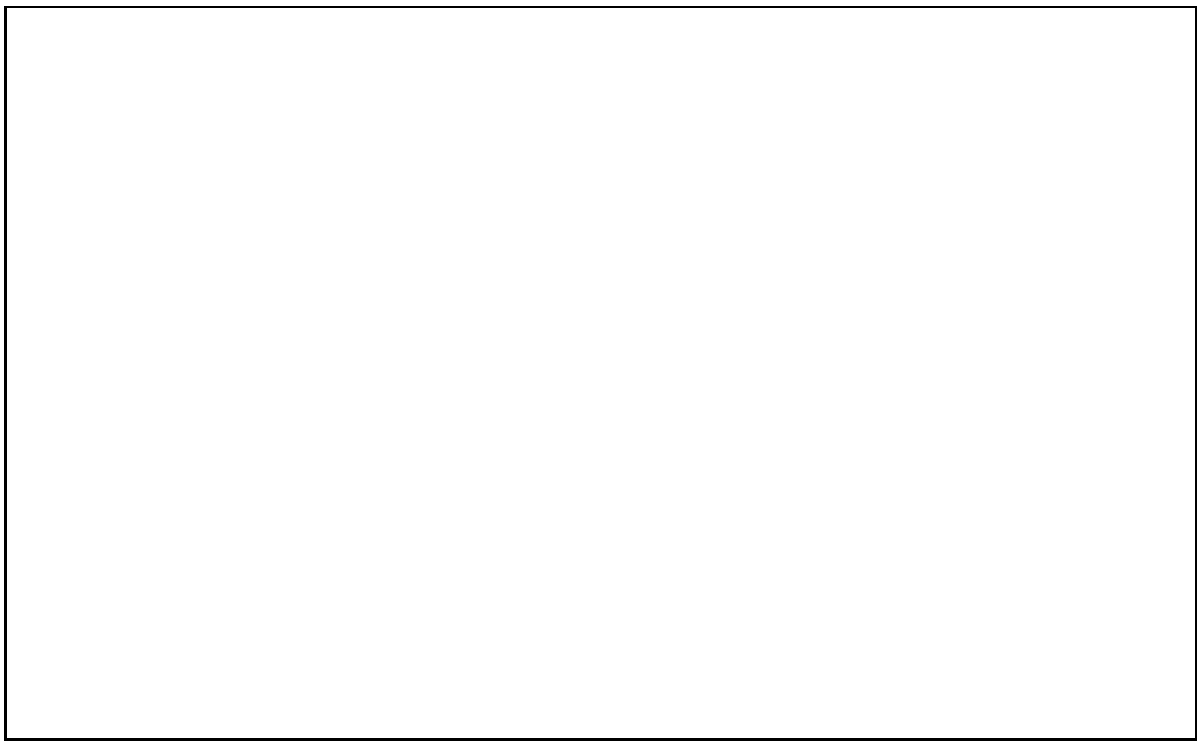
Matrix Operations (4 / 5)

Example(s):



Matrix Operations (5 / 5)

Example(s):



Identity Matrices

Remember the concept of Multiplicative Identity?

Definition: Identity Matrices

Matrix Powers

Definition: n^{th} Matrix Power

Example(s):

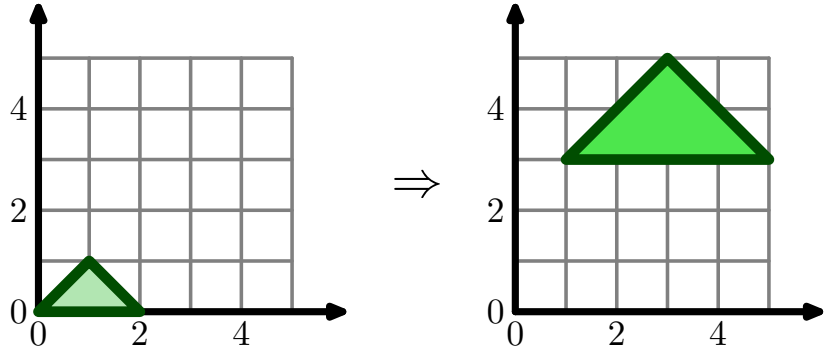
Example: Affine Transformations (1 / 3)

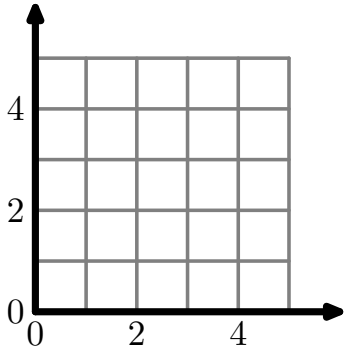
Used to ‘move’ objects in computer graphics.

Background:

Example: Affine Transformations (2 / 3)

Task:





Example: Affine Transformations (3 / 3)

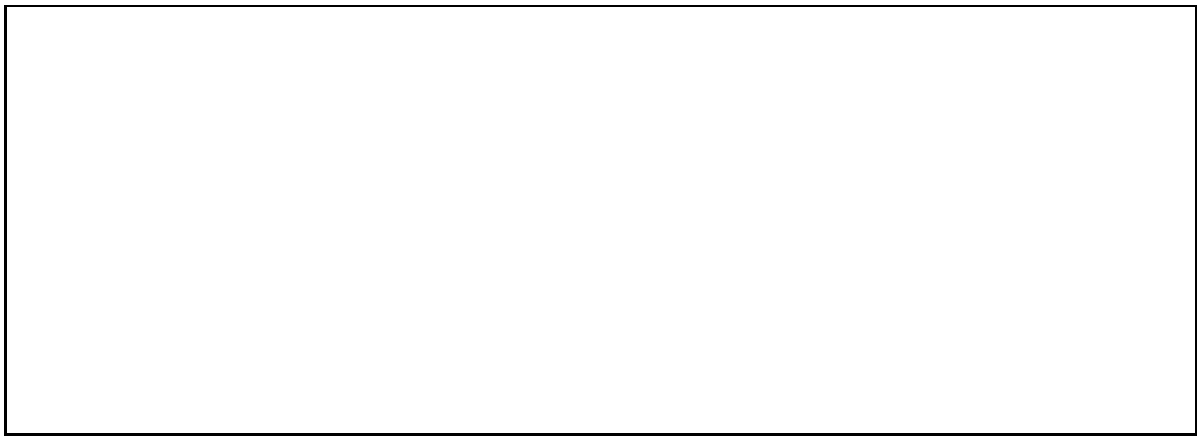
Zero-One Matrices (1 / 3)

Three Operations:

1. ‘Join’:

2. ‘Meet’:

Example(s):



Zero-One Matrices (2 / 3)

3. Logical Matrix Product (a.k.a. Boolean Product):

Example(s):

Zero-One Matrices (3 / 3)

Definition: r^{th} Logical Matrix Power (a.k.a. Boolean Power)